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# PSYCHE

Vol. 59 December, 1952 No. 4

## THE BIOLOGY OF NEARCTIC LEPIDOPTERA. II. FOODPLANT AND PUPA OF *HEMIARGUS ISOLUS*

By Charles L. Remington
Osborn Zoological Laboratory, Yale University

In early July 1943, about 10 mi. S. of Abilene, Taylor Co., Texas, I discovered a lycaenid larva feeding on a large pod of mesquite, *Prosopis juliflora* (Swartz) DC. It was confined and fed, and on 18 July it pupated. The imago emerged on 25 July and proved to be *Hemiargus* (*Echinargus*) *isolus* (Reak.). This was of considerable interest, since the life-history and foodplants of this very common Blue were wholly unknown. During August and September *H. isolus* was abundant in *Prosopis* groves, but no more larvae were found. While *Prosopis* may be the primary foodplant in the Southwest wherever it occurs, it obviously is not the only plant; *H. isolus* ranges far beyond the limits of *Prosopis* in the West and even appears to have endemic colonies east of the Mississippi (Remington, 1942). Other species of *Hemiargus* have been recorded feeding on *Prosopis, Mimosa, Macroptilium, Chamaecrista, Abrus, Pithecolobium, Guilandina, Astragalus,* and *Medicago.* The foodplant record for *H. isolus* in Klots' new book (1951, p. 159) is based on a verbal communication from the writer.

This being the first record of early stages of *H. isolus,* a brief description, prepared from the pupal shell, is given as follows: length 6.2 mm.; length of dorsum of abdomen (ignoring curvature) 4.0 mm.; width of abdomen just caudad of wing cases 1.9 mm.; length of maxillary sheath 2.2. mm. (extending 1.0 mm. beyond tip of sheath of prothoracic legs and 0.3 mm. beyond sheath of mesothoracic legs and exceeded by wing cases and antennae by 4.0 mm.) ; hairs very sparse, especially on dorsum, but of highly distinctive shape — columnar and very rough in outline, not

strongly capitate, never slender or smooth, rarely spiculately branched; longest hairs less than 0.15 mm. long; spiracles of abdominal segments II and III very far laterad, touching margin of tergal plates, sparsely surrounded by hairs and by papillae, the latter most numerous caudad of spiracle; three well-separated groups of hooklets near end of abdomen ventrally: — a median ventro-caudal clump of about 30 hooklets on extreme end of last dorsal plate (terga IX-X?) and a pair of ventro-lateral clumps of about 23 hooklets each, on anterior edge of last ventral plate (sterna VIII-X?).

The combination of characters given above distinguishes the pupa of *H. isolus* from all Lycaenidae known to me. The pupa was held firmly to its substratum by a strong girdle.

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1951. A Field Guide to the Butterflies of North America, East of the Great Plains. 349 pp., 40 pls. Houghton Mifflin Co., Boston.

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1942. The Distribution of *Hemiargus isola* (Reakirt) East of the Mississippi River. Bull. Brooklyn Ent. Soc., 37: 6-8.

# *PSEUDOMYRMEX APACHE*, A NEW SPECIES FROM THE SOUTHWESTERN UNITED STATES (HYMENOPTERA: FORMICIDAE)[1]

By William S. Creighton
Department of Biology, College of the City of New York

The majority of the material on which this paper is based was secured during 1951 and 1952. At that time the writer was engaged in a field survey of the ants of the border region. This work was made possible by a fellowship from the John Simon Guggenheim Memorial Foundation. My sincere thanks go to the Foundation for the support which made this work possible.

The taxonomy of the genus *Pseudomyrmex* presents an unusual number of difficulties. Even the generic name has not escaped the hazard of uncertainty. The name *Pseudomyrma*, which has been accepted for more than a century, has recently been challenged. Twice in the past two years Dr. M. R. Smith has introduced prior names for the genus. The latest choice is *Pseudomyrmex* Lund which, on the basis of data presented by Dr. Smith in 1952 (Proc. Ent. Soc. Wash., Vol. 54, No. 2, p. 97) has a priority of thirteen years over *Pseudomyrma* Guérin. But any difficulty with the generic name is a minor matter in contrast to the deplorable incertitude which marks a large number of the species in this genus. The taxonomy of many of them is in such confusion that specific recognition is largely a matter of guess-work. With this fact in mind, the writer has hesitated for some time to describe the material treated here. It would seem, however, that we can no longer avoid dealing with this material for, whatever its taxonomic status may be, it is certain that its presence in the southwestern United States has not previously been recognized. It is probable that the older records for this ant have been attributed to *Ps. pallida*. The two insects are superficially

[1] Published with a grant from the Museum of Comparative Zoology at Harvard College.

similar and they occur in the same stations in the southwest. As long as it was believed that only *pallida* occurred in this area, there was little reason to suspect the existence of a second species.

The writer first encountered *Ps. apache* in 1932. In September of that year a single, deälated female was taken in Ramsey Canyon in the Huachuca Mountains of Arizona. This insect had a clear, yellow color similar to that of *Ps. pallida,* but it differed from the female of *pallida* in its much greater size and in a number of other structural features. Since no workers were associated with the above female, its status was problematical and it was not included in my 1950 monograph on North American ants. In the spring of 1949, after that paper had gone to press, Dr. L. F. Byars sent me a number of workers of a large, yellow *Pseudomyrmex* which had come from three colonies taken in southern Arizona. These seemed to be the same species as the female from Ramsey Canyon, but this was not verified until the following summer. In 1950 a colony containing all three castes was taken by the writer in Garden Canyon in the Huachuca Mountains. Since that time the writer has secured forty-five additional colonies of this ant in fifteen different stations. These stations extend from the Brownsville area of Texas to the mountains of southern California. It is clear that this ant is abundant in the southwestern United States and some cognizance must be taken of it. The difficulty is to decide how this insect should be treated.

The writer first believed that this ant represented *Ps. decipiens* or a northern race of it. Dr. W. M. Wheeler had identified as *decipiens* a series of specimens taken in Costa Rica. These specimens were similar to those coming from the southwestern United States but there were several differences, particularly in the shape of the petiole. In 1949, when the above comparison was made, there was not enough material to evaluate these differences. As a result the writer told Dr. Byars that the insect probably represented some form of *decipiens,* but that no certain statement could be made until more data was available. In the meantime the writer attempted to discover how Dr. Wheeler had identi-

fied the Costa Rica specimens. As far as could be ascertained there are no types of *decipiens* in American collections. Nor do there seem to be any specimens other than types which Forel might have determined. Apparently Dr. Wheeler used Forel's description as the basis for his identification and, as will be shown, this is a bad business at best. The original description of *decipiens* appeared in the ant section of the *Biologia Centrali-Americana*. It was based upon specimens coming from Teapa, a small town in the state of Tabasco, Mexico. The description is brief, but this is not the worst than can be said for it. It is sufficiently explicit to show that it does not accord in several important respects with the figure which is supposed to accompany it. These differences are so marked that there is justification for the view that the description and the figure can scarcely have been drawn from the same insect. In the figure the size of the eyes, the length of the antennal scapes and the proportions of the petiolar joints do not correspond at all to the description. Forel did not prepare the figure but he undoubtedly wrote the description, hence the latter seems more reliable as an indication of the characteristics of *decipiens*. Wheeler had evidently reached this conclusion, for his Costa Rica specimens agree much better with Forel's description than with his figure. But it should be clear that there can be no certainty as to the exact nature of Forel's *decipiens* until the types can be re-examined.

At the same time it seemed to the writer that it should be possible to clarify the status of specimens coming from the southwestern United States by collecting in northern Mexico. If the southwestern specimens were a northern race of *decipiens*, the two should intergrade at some point between Tabasco and the southern border of the United States. The survey work mentioned above gave an ideal opportunity to test this in the field. During January and February of 1952 careful vertical surveys were made in the mountains of eastern Mexico at three latitudes. The southernmost of these was in the Tamazunchale area. This survey ranged from three hundred feet to eight thousand feet. Similar studies were made in the mountains west of

Linares (1300-6200 feet) and in those south and west of Monterrey (2000-7200 feet). By this time it was apparent that *Ps. apache* prefers to nest in old live oak limbs. Many hundred limbs of live oaks were examined in the areas mentioned above. While three different species of *Pseudomyrmex* were encountered in these limbs, none of them showed the slightest relation to *apache*. The coastal plain was less thoroughly studied, but collections made in the area between Mante and Tampico showed no trace of *apache*. The only abundant *Pseudomyrmex* in that area is a particularly vicious, light brown species which lives in the thorns of the bull-horn Acacia. In northwestern Mexico the situation is essentially similar. *Ps. apache* is abundant in the mountains at the northern end of the main chain of the Sierra Madre Occidental. But the writer failed to find it in several lesser ranges in northern Sonora. It may be added that in some of these ranges the conditions seemed ideal for this ant and the writer felt certain that it would be found. Negative evidence of this sort does not prove the absence of *Ps. apache* in the areas mentioned above, but it does prove that the insect is less abundant in these areas than in stations further north. This would not be true if this ant were a northern fringe of some southern species, for in that case its incidence should increase to the south. But, since all available evidence points to the fact that the area of greatest abundance for this ant lies in southern Arizona and that its incidence decreases to the south, it is safe to conclude that the insect is not a northern race of *decipiens* but a separate species.

Since all three castes have been figured on the plate which accompanies this article, the descriptive material which follows is largely limited to details of sculpture and pilosity that could not be shown in the figures.

**Pseudomyrmex apache** sp. nov.
Plate 12

Female: head (mandibles excluded) 1.35 mm.; thorax 2.2 mm.; overall length 7-8 mm.

Upper surface of the head covered with small, shallow, circular punctures. These punctures close set from the anterior margin of the head to the level of the median ocel-

lus. From that level to the occipital border the punctures are much more widely spaced with the surface between them delicately coriaceous or reticulate and very feebly shining. The punctures on the genae and gula are notably smaller and more widely spaced than those on the front of the head. Both genae and gula are feebly shining. Clypeus and frontal lobes without distinct punctures and rather strongly shining. Mandibles with coarse, oval, piligerous punctures, the surface between them finely shagreened. Antennal scapes with numerous fine punctures, their surface more shining than the front of the head but less shining than the frontal lobes. Punctures on the thorax smaller, more shallow and more widely spaced than those on the front of the head, the surface between the punctures with a very delicate, reticulate sculpture. Pronotum and epinotum feebly shining. Scutum, scutellum, mesothoracic sternite and episternite a little more strongly shining. Punctures on the petiole very sparse and fine. Postpetiole and gaster with only a few, scattered, piligerous punctures. The delicate coriaceous sculpture becomes feebler as one passes from the petiole to the gaster and the parts become progressively more shining, with the gastric segments particularly so. Fore femora laterally compressed. Middle and hind femora not laterally compressed. Both femora and tibiae with numerous, very small punctures which do not dull the shining surface.

Erect hairs rather sparse over most of the body. Mandibles and antennal scapes with moderately numerous, short, erect hairs. Those on the upper surface of the head and on the gula much sparser, widely separated and very irregular in length. Dorsum of the pronotum with six or eight erect hairs. Scutum and scutellum with about a dozen erect hairs of varying lengths. Epinotum without erect hairs. Petiole and postpetiole with eight or ten erect hairs each. These hairs are often, but not always, confined to the posterior half of each node. Erect gastric hairs largely confined to a broad band at the rear edge of each segment. Legs virtually devoid of erect hairs, except for one or two on the fore coxae and the fore femora. Tarsal joints and antennal funiculi densely covered with fine, semi-erect hairs

which grade into pubescence. Pubescence elsewhere very fine and so sparse that it is not usually noticeable except under considerable magnification or in very oblique light.

Color: clear, golden yellow, the inner border of the mandibles blackish brown. Edges of the thoracic sclerites and gastric segments a slightly deeper brownish yellow than the rest of the surface. Wings slightly iridescent, faintly tinged with yellow, the veins a deeper yellow, the stigma brown.

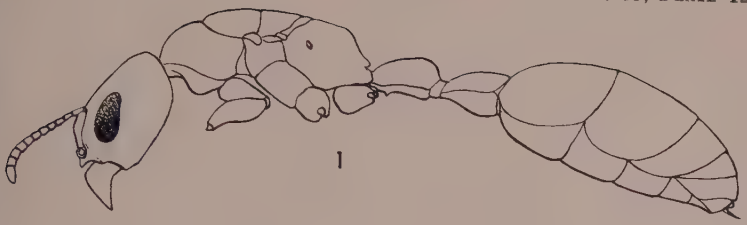
Male: head (mandibles excluded) 1.0 mm.; thorax 2.0 mm.; overall length 6.5-7.0 mm.

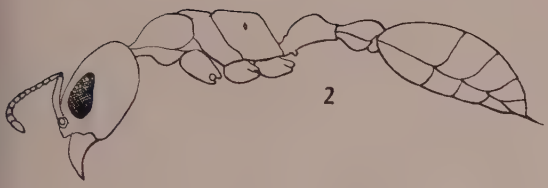
Upper surface of the head finely coriaceous and feebly shining except for the area between the median ocellus and the antennal insertions, where the coriaceous sculpture is largely replaced by fine punctures. Mandibles a little more heavily sculptured and less shining than the rest of the head. Antennae finely and densely granulose, opaque. Lateral portions of the pronotum feebly coriaceous, less shining than the median portion which is covered with rather coarse, scattered punctures. Scutum and scutellum heavily coriaceous and dull except for an irregular, shining band down the middle of each. This band is coarsely punctate and very feebly coriaceous. Epinotum feebly coriaceous and rather strongly shining above, more heavily coriaceous and punctate on the sides. Mesothoracic sternite strongly shining and coarsely punctate, the episternite feebly coriaceous and strongly shining. Petiolar nodes feebly shining and weakly coriaceous. The gaster very feebly sculptured and much more shining than the petiolar nodes.

Erect hairs present on the ocellar area of the head, the scutum and the scutellum. Dorsum of the epinotum, the petiolar nodes and the dorsum of the anterior gastric segments with one or two erect hairs each at most, often hairless. Dorsum of the terminal gastric segment with several erect hairs. There are numerous erect hairs, which form

EXPLANATION OF PLATE 12

*Pseudomyrmex apache* sp. nov. Fig. 1. Female, profile view. Fig. 2. Worker, profile view. Fig. 3. Head of female. Fig. 4. Petiole and postpetiole of worker, from above. Fig. 5. Head of worker. Fig. 6. Head of male. Fig. 7. Male, profile view.



CREIGHTON — PSEUDOMYRMEX APACHE

a distinct fringe, at the ventral edge of each gastric segment. Eyes with a number of short and extremely fine erect hairs. Mandibles with numerous, coarse, erect or semierect hairs. Pubescence abundant and fully appressed on the rear half of the head, semierect on the anterior half and on the gula. Pubescence on the thorax and the petiolar nodes much more dilute than on the head. Pubescence extremely dilute on the dorsum of the gaster but more abundant on its sides and ventral surface. Antennae and tarsi with abundant, short, appressed or semierect hairs which grade into pubescence. Femora and tibiae with less abundant pubescence than the tarsi.

Color: thorax, gaster, legs and antennae dirty yellowish brown. The scutum and the head a darker, more piceous brown. Mandibles dingy yellow. Wings pale, yellowish brown, the veins and stigma darker.

Worker: head (mandibles excluded) 1.15 mm.; thorax 1.5 mm.; overall length 5-6 mm.

Upper surface of the head covered with circular punctures, as in the female, but with the coriaceous sculpture between the punctures much less pronounced, particularly on the rear half of the head. This gives the surface a slightly more shining appearance than in the female. Mandibles much smoother than those of the female, the piligerous punctures notably smaller and, for the most part, circular or nearly so. Punctures on the thoracic dorsum obscured by the even, coriaceous sculpture. This sculpture is also present on the sides of the thorax. Both dorsum and sides of the thorax feebly shining. Sculpture of the petiolar nodes and the gaster the same as in the female. Fore femora much less laterally compressed than in the female, not greatly different in shape from the middle and hind femora. The fine, coriaceous sculpture on the appendages more distinct than in the female, often obscuring the punctures, hence the legs are less shining than in the female.

Pilosity on the head very similar to that of the female. Erect hairs on the thoracic dorsum, when present, sparse and confined to the pronotum and mesonotum. A few erect hairs are present on the petiole, the postpetiole and the dorsum of each gastric segment, especially the last. Pube-

scence fine and obscure, very dilute on the head, more abundant on the thorax, petiolar nodes and gaster, but nowhere conspicuous.

Color: uniform, clear, golden yellow. In some specimens the posterior gastric segment is slightly infuscated.

Types of female, male and worker deposited in the collection of the Museum of Comparative Zoology, Cambridge, Mass.; the type locality is Brown Canyon (4400′), Baboquivari Mts., Arizona. Type nest taken on Sept. 2, 1951, in *Quercus oblongifolia.*

Because of its clear, yellow color and dilute pubescence *apache* is not likely to be confused with any of our other species except *pallida.* There is little likelihood of confusion between these two species if all castes are present, for *apache* is larger than *pallida* and this difference is particularly striking in the sexual forms. Workers from young nests of *apache* are, however, sometimes no larger than those of *pallida.* In such cases recognition depends upon other criteria which will separate the two species regardless of size. Thus the worker of *apache* is more heavily sculptured than that of *pallida,* particularly on the upper surface of the head. In *apache* the cephalic punctures and the delicate, coriaceous sculpture between them can be readily seen, even under medium magnification, and the surface of the head is feebly shining. In *pallida* the cephalic sculpture is notably finer. The punctures are scarcely distinguishable from the sculpture between them, even under high magnification, and the surface of the head is moderately shining. The head of *apache* is broader in proportion to its length, with the sides more convex than is the case with *pallida.* The greatest length of the eye in *apache* is slightly less than one half the distance from the insertion of the mandible to the occipital margin. In *pallida* the greatest length of the eye is slightly more than one half the above distance. The petiolar node of *apache,* seen in profile has a broadly rounded crest, from which both the anterior and the posterior face slope away at about the same angle. Thus the outline of the node appears as a flattened and slightly lopsided arc. In *pallida* the rear face of the node of the petiole descends much more abruptly

than the front face, hence, in profile the node presents a wedge-shaped rather than an arcuate outline.

The distributional records for *apache* are presented below. Unless otherwise noted all specimens were taken by the writer. The elevations of the majority of these records were checked with topographic sheets and an altimeter, the remainder with one or the other.

ARIZONA:

Huachuca Mountains: Ramsey Canyon (5500′) single deälated female; Garden Canyon (5800′) three colonies in *Quercus emoryi;* Carr Canyon (5400′) two colonies in *Q. emoryi.*

Santa Rita Mountains: Madera Canyon (5900′) one colony in *Q. emoryi;* Sweetwater (5800′) three colonies in *Q. emoryi.*

Dragoon Mountains: Cochise Stronghold (5200′) one colony in *Q. emoryi.*

Chiricahua Mountains: Chiricahua National Monument (5400′) one colony in *Q. emoryi.*

Peloncillo Mountains: Cottonwood Canyon (4800′) two colonies in *Q. emoryi.*

Baboquivari Mountains: Baboquivari Canyon (3500′) one colony in *Q. oblongifolia;* Brown Canyon (4200-4400′) type locality, nine colonies in *Q. emoryi* or *Q. oblongifolia.*

Ajo Mountains: (Organpipe Cactus National Monument) Alamo Canyon (2200-2800′) ten colonies, eight in *Prosopis juliflora,* two in *Q. turbinella.*

Growler Mountains: (Organpipe Cactus National Monument) La Abra Wash (1300′) two colonies in *Prosopis juliflora.*

Canelo Hills: Canelo Pass (5300′) one colony in *Q. emoryi.*

Pena Blanca Springs (3900′) Santa Cruz Co. Coll. L. F. Byars, one colony without data on nest site.

San Miguel (2400′) Pima Co. Coll. L. F. Byars, one colony in *Prosopis juliflora.*

Organpipe Cactus National Monument Headquarters (1650′) Coll. E. R. Tinkham, one colony, said to have been taken emerging from a rodent's burrow!

CHIHUAHUA:

Sierra de en Medio: Nogales Ranch (5000′) five colonies in *Q. emoryi* or *Q. oblongifolia.*

TEXAS:

Fowlerton (300′) La Salle Co., one colony in *Prosopis juliflora;* Monte Alto (60′), Hidalgo Co., two colonies in *P. juliflora.*

CALIFORNIA:

Agua Tibia Mountains: Dripping Springs (1500′) two colonies in *Q. chrysolepis.*

The records cited above show that *Ps. apache* occurs most frequently in mountainous areas at elevations between 2500 and 6000 feet. In such stations it ordinarily nests in evergreen oaks but, when the range descends below the oak belt, it will nest in mesquite. Whether the ants nest in oak or mesquite they select a good-sized branch or the trunk of the tree as a nest site. They seldom nest in twigs and this response is striking in view of the fact that twigs are a favorite nest site for our eastern species. The branches selected by *apache* are those through which wood-boring insects have driven passages. The ants carefully clean these passages of the detritus left by the insects which made them. In most cases the passages have a diameter several times as great as that of the ants, hence it would seem that the ants could be jarred out of the open ends of the passages without difficulty. This is not the case, for they cling to the walls with great tenacity. To get all the specimens out of a nest it is usually necessary to split the branch into small pieces so that all the passages are exposed. *Ps. apache* is not at all pugnacious. It will bite on occasion but it very rarely stings and the sting is not painful. Since many species of *Pseudomyrmex,* some much smaller than *apache,* sting severely on the slighest provocation, this behavior is rather surprising.

The female of *apache* often becomes physogastric after the colony is well established. The intersegmental membranes do not bulge but are stretched tight between the separated gastric sclerites. Since the latter retain their curvature, the gaster of a physogastric female of *apache* looks like a white tube running through a series of close-

fitting, golden rings. In this species brood is usually present during the entire year. In some nests this is also true of the sexual forms. Fully mature males and winged females have been taken from nests as early as March 20th and as late as November 3rd. In southern Arizona and northern Chihuahua most nests are free from sexual forms by the first of October. It seems clear, however, that the sexual forms occasionally remain in the nest over the winter. Four colonies containing mature males and females were taken in the Ajo Mountains of Arizona on March 20th and 21st, 1952. Four days before snow had fallen in this area and the winter had been an unusually cool one. If the males and females in the above nests came from early spring brood it was certainly a remarkable performance. It is more reasonable to suppose that they had overwintered in the nest. It appears that there is no mass egress of males and females in the marriage flight of this species. The writer had it under daily observation during September in 1951. Although there were many males and females in the nests during that period no marriage flight was seen. But during the month of September a number of deälated, nest-founding females were taken. Since these had not been encountered earlier, the presumption is that some sort of marriage flight was taking place during September. If this had been of the usual type it is hard to see how it could have been overlooked. It seems probable that the marriage flight of *apache* extends over much of the month of September, with the males and virgin females leaving the nest in comparatively small numbers at intervals during that period.

# THE GENUS *PARADA* HORVATH (HEMIPTERA: TINGIDAE)[1]

By Carl J. Drake
Iowa State College, Ames

Horvath (Ark. Zool., 17A(24) :2-3, 1925) erected *Parada* as a subgenus of the genus *Cysteochila* Stål for the reception of *Cysteochila* (*Parada*) *taeniophora*. Seventeen years later, Drake (Iowa St. Coll. J. Sci., 17(1) :3-4, 1942) raised *Parada* to the generic level and described two new species and a new variety from Australia. The genus is not known to occur elsewhere.

The present paper describes three new species and one new variety of the genus *Parada* from Australia. I am indebted to Dr. Philip Darlington of the Museum of Comparative Zoology, Harvard University, for kindly loaning me the tingids, which he collected in Australia. The disposition of the types is given beneath the descriptions of the new species.

Genus *Parada* Horvath, 1925

Type, *Cysteochila* (*Parada*) *taeniophora* Horvath, 1925

**Parada darlingtoni,** new sp.

Head brown, with five testaceous spines; median spine short and blunt, the hind pair shorter in type than allotype, appressed. Eyes moderately large, black. Antennae long, rather slender, pale testaceous, the terminal segment almost totally black-fuscous; segment I short, stout, thicker and nearly twice as long as II; III very long, slenderest, smooth, scarcely more than four times as long as IV. Bucculae very wide, meeting in front, testaceous, areolate. Rostrum testaceous, extending to middle of metasternum; rostral laminae testaceous, areolate, subparallel, open behind.

Pronotum strongly convex, closely coarsely deeply pitted, black with hood, paranota, carinae and posterior projection testaceous, the posterior part of pronotum distinctly

[1] Published with a grant from the Museum of Comparative Zoology at Harvard College.

areolate. Hood moderately large, inflated, not produced over base of head, highest near the center, there feebly higher than long, above narrowed from all sides to the peak; collar testaceous. Paranota moderately wide, mostly triseriate, almost completely reflexed inwardly on surface of pronotum, usually not quite touching pronotal surface at humeral angles. Median carina long, distinctly elevated, not areolate, extending from hood to apex of hind process. Lateral carinae a little sinuate, foliaceous on discal part of pronotum, there completely reflexed inwardly and biseriate in widest part, the space between upper edge and median carina about half as wide as width of lateral carina; lateral carinae on hind part ridge-like and not areolate.

Hemelytra strongly constricted beyond the middle, yellowish brown with four dark fuscous marks on the veins setting off discoidal area, the whitish patch near apex of costal area extending across subcostal into sutural area; costal area moderately wide, composed largely of one row (two at base) of fairly large, clear cells; subcostal area triseriate, the cells smaller than in costal area; discoidal area just reaching to middle of hemelytra, with outer boundary strongly sinuate, widest slightly beyond the middle, there six or seven cells deep; sutural area more widely reticulate, with cells infuscate, with a pale patch near apex; areolae of subcostal, discoidal and sutural area opaque. Wings clouded with dark fuscous, not as long as hemelytra. Hypocostal vein uniseriate. Body beneath black-fuscous, the median part of venter sometimes brownish. Legs testaceous, the tips of tibiae and tarsi reddish brown to fuscous.

Length, 3.50-3.75 mm.; width, 1.20-1.38 mm.

Type (male), National Park, Queensland, McPherson Range, Australia, Alt. 3000-4000 feet, May 11, 1932, collected by Dr. P. J. Darlington, in collection of Museum of Comparative Zoology (Harvard). Allotype, female, taken with type.

This species may be separated at once from other members of the genus by the narrower, biseriate lateral carinae of pronotum. The hood is about the same size as in *P. popla* Drake, but the antennae and legs are distinctly longer. *P.*

*absona* has a distinctly smaller hood, and wider foliaceous part of lateral carina.

**Parada hackeri,** new sp.

Moderately elongate, small, oblong. Head flat above, reddish brown with five testaceous spines; median spine short, appressed; anterior pair longer, porrect, with their tips touching; hind pair very long, appressed. Antennae moderately long, moderately stout, indistinctly pilose, testaceous with terminal segment dark fuscous; segment I short, a little stouter and not quite twice as long as II; III slightly more than twice as long as IV; IV thicker in widest part, narrowed at base and apex, clothed with short hairs. Bucculae wide, testaceous, areolate, closed in front. Rostrum testaceous, extending a little beyond middle of mesosternum; rostral laminae testaceous, areolate, open behind. Entire body beneath dark reddish brown.

Pronotum slightly convex, closely deeply pitted, reddish brown with carinae, paranota, hood and posterior projection of pronotum testaceous; hood moderately large, only slightly raised, about one cell high, flat above, not produced anteriorly. Paranota moderately wide, mostly triseriate, almost totally reflexed inwardly, not quite resting on dorsal surface of pronotum at humeral angles. Lateral carinae long, foliaceous on convex part of pronotum, there reflexed inwardly and triseriate, continuing on hind part of pronotum as a raised vein, which terminates a little before the apex. Median carina profound, not areolate. Hind process of pronotum about as widely areolate as discoidal area.

Hemelytra slightly constricted a little beyond middle, brownish; costal area narrow, uniseriate, the cells small and mostly longer than wide, testaceous with some scattered dark fuscous spots on outer vein; discoidal area wider, biseriate, with larger cells; discoidal area large, extending considerably beyond middle of hemelytra, set off from other areas by raised veins (especially inner boundary), narrowed at both base and apex, slightly elevated at apex and at dark spot on outer boundary, widest near middle, there five cells deep, the outer marginal vein only slightly sinuate; sutural area more widely areolate, with veinlets yellowish brown and areolae dark fuscous. Wings black-fus-

cous, almost as long as hemelytra. Legs rather short, testaceous.

Length, 3.00 mm.; width, 1.00 mm.

Type (male), Mt. Gipps, Queensland, Australia, April 20, 1930, H. H. Hacker, in collection of C. J. Drake.

This is the smallest described species in the genus. It can be distinguished from its congeners by the non-inflated hood, narrow costal area, feebly convex pronotum and flat dorsal aspect of head as well as smaller size of body.

**Parada absona**, new sp.

Oblong, testaceous, with the last antennal segment, and anterior and discal parts of pronotum black, also a long mark on raised boundary veins (beyond middle) between discoidal and subcostal areas, a small spot beyond apex of discoidal area and a subapical spot in discoidal area dark fuscous. Hood, collar, carinae, paranota and posterior part of pronotum testaceous.

Head black, with five testaceous spines. Antennae long, indistinctly pilose; segment I short, stouter and a little longer than II; III three times as long as IV. Rostrum testaceous, extending a little beyond mesosternum. Rostral laminae areolate, testaceous, open behind. Bucculae, wide, testaceous, closed in front. Legs moderately long, testaceous.

Pronotum strongly convex, deeply coarsely closely pitted, tricarinate; hood rather small, inflated, not very high, bell-shaped, not extending posteriorly over convex part of pronotum; paranota moderately wide, triseriate, almost completely reflexed, not quite touching surface of pronotum opposite humeral angles. Median carina profound, moderately raised, without distinct areolae. Lateral carinae sinuate, moderately wide and foliaceous on pronotum proper, there completely reflexed inwardly, each continued as a raised nerve on hind process, the space between upper edge of foliaceous part and median carina about half as wide as carina.

Hemelytra moderately constricted beyond the middle; costal area moderately wide, mostly uniseriate, biseriate for a short distance at base, the cells moderately large and hyaline; subcostal area a little wider, biseriate; discoidal area long, about three-fourths as long as hemelytra, with

outer boundary only a little sinuate, widest beyond middle, there six cells deep, narrowed at both base and apex; sutural area with cells a little larger; hypocostal vein uniseriate. Wings deeply clouded with dark fuscous, not as long as hemelytra.

Type (male), Lake Barrine, Queensland, Australia, El. 2900 feet, April 19, 1932, P. J. Darlington, in Museum Comparative Zoology (Harvard). Allotype and 4 paratypes, taken with type.

This species is most closely allied to *P. torta* Drake, but is easily separated from it by the longer body, much shorter and smaller hood, longer carinae and shape of discoidal area. The hood of *P. torta* is much larger and projects backwards over anterior part of convex pronotum.

*Parada torta* Drake

*Parada torta* Drake, Iowa St. Coll. J. Sci., 17 (1) :4, 1942.

Six specimens, Mt. Wilson, Blue Mts., N. S. W., Australia, El. 8500 feet, Jan., 1932, P. J. Darlington. Known heretofore only from the type locality, Mt. Gipps, Queensland.

**Parada torta pulla,** new var.

Separated from typical form by the black head, pronotum, hood, paranota, carinae and discoidal and large part of subcostal areas of hemelytra. Size same as typical form, 3.00 mm. long.

Type (female), Mt. Wilson, Blue Ridge, El. 8500 feet, N. S. W., Australia, P. J. Darlington, in Museum Comparative Zoology (Harvard).

*Parada popla* Drake

*Parada popla* Drake, Iowa St. Coll. J. Sci., 17 (1) :3, 1942.

Numerous specimens, National Park, McPherson Ridge, Queensland, Elevation 3,000-4,000 feet, March 11, 1932, P. J. Darlington.

*Parada taeniophora* Horvath

*Cysteochila* (*Parada*) *taeniophora* Horvath, Ark. Zool 17A (24) :2, p. 2. 1925.

Several specimens, Mt. Surgeon, N. Q., Australia, El. 3,500-4,000 ft., July 28, 1932; Lake Barrine, Atherton Tab., El., 2,800 feet, April 28, 1932, all by P. J. Darlington.

# STUDIES ON ARIZONA ANTS (4)
# *CAMPONOTUS (COLOBOPSIS) PAPAGO*, A NEW SPECIES FROM SOUTHERN ARIZONA[1]

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This paper deals with ten colonies of *Colobopsis* taken by the writer in southern Arizona during the summers of 1950 and 1951. The work done during the second summer was made possible by a fellowship from the John Simon Guggenheim Memorial Foundation. Most of the observations on habits carried in this paper were made during the first months of a fifteen month survey of the ants of the southwestern United States and northern Mexico. I am happy to take this opportunity to express my sincere appreciation for this fellowship. I wish to thank Mr. Harry Stevens, the United States Agent in charge of the Papago Indian Reservation at Sells, Arizona, for his kindness in permitting us to use the Forestry Cabin on the western slope of the Baboquivari Mountains. We are also grateful to Mr. and Mrs. Forrest Perkins, who generously turned over their ranch house to us during our stay on the eastern slope of the Baboquivaris. The comfortable surroundings provided in each case greatly facilitated the work with the ants.

The older records for the species described in this paper were regarded by W. M. Wheeler as representatives of *C.* (*Colobopsis*) *cerberulus* Emery. For reasons which will be given later, I feel that it is a much sounder procedure to treat this ant as a new species. To do so involves the risk that it may subsequently prove to be *cerberulus*, as Wheeler supposed. But this risk must be taken if we are ever to get out of the fog which has obscured *cerberulus* from the time of its original recognition. In 1920 Emery described *cerberulus* from a single, winged female taken in the state

[1] Published with a grant from the Museum of Comparative Zoology at Harvard College.

of Michoacan, Mexico (1). It is hard to understand why Emery felt that this specimen should be named. During the fifty years of entomological work which lay behind him, Emery had often struggled with the difficulties that result whenever a new species of ant is based on a dissociated female. Moreover, by 1920 the importance of accurate field data to an original description was clearly recognized. Yet Emery elected to describe an insect which wholly lacked significant field data. That the ant was known to have been taken in Michoacan is of scant significance, for that state has a singularly diverse topography and a corresponding diversity of biotic associations. Finally, Emery's description of *cerberulus* was brief and without figures. It was certain from the start that this description would be a source of trouble for, under the circumstances, nothing but a miracle could prevent subsequent confusion in the case of *cerberulus*.

Most of Emery's short description of *cerberulus* consists of a comparison of his unique type with the female of Wheeler's *etiolatus*. From the nature of this comparison it is evident that Emery had specimens of *etiolatus* at the time that he wrote the description of *cerberulus*. When Wheeler described *etiolatus* in 1904 (2) he presented no figure of the female and his description of that caste lacks certain features which Emery later cited. It is certain, therefore, that Emery had authentic material of *etiolatus*, probably from that part of the type series which Wheeler sent to Forel. It would otherwise have been impossible for Emery to have presented the characterization of the *etiolatus* female which he used in his comparison with the female of *cerberulus*.

The fact that this comparison utilized the female of *etiolatus* may well be what led Wheeler to believe that he could recognize the essential features which distinguish *cerberulus;* for Wheeler had type females of *etiolatus* in his own collection and with these as a guide he could secure a much more exact idea of the female of *cerberulus* than would be expected from Emery's brief account of that insect. It is now certain that Wheeler overestimated the utility of Emery's description. It is good enough to

give a general idea of the female of *cerberulus* but it lacks the finer points which are necessary for the work that Wheeler attempted.

In 1920 Wheeler had in his collection a number of males and females of *Colobopsis* taken in southern Arizona. These specimens came from Texas Pass in the Dragoon Mountains, Sabino Basin in the Santa Catalina Mountains and Black Dike Prospect in the Sierrita Mountains. The specimens from Texas Pass had been taken by Wheeler at light. No field data accompanied the other specimens. Soon after Emery published his description of *cerberulus*, Wheeler identified the above specimens as that species. But no reference was made to them until 1934. In that year Wheeler published a paper (3) in which he attributed the Arizona material to *cerberulus*. He also described as *cerberulus* three major workers which Dr. Elizabeth Skwarra had collected near the city of Vera Cruz, Mexico. These specimens were taken in a hollow spine of *Acacia sphaerocephala*. Wheeler's association of the Arizona females with the Michoacan type was made on the basis of Emery's description. This could be defended, since the same caste was involved in each case. but the association of the Vera Cruz majors with *cerberulus* was a different matter. It was based on a comparison of the Vera Cruz majors with the Arizona females and on Wheeler's unsupported belief that the former represented the unknown major caste of *cerberulus*. I was forced to deal with this extraordinary double association when I was preparing the *Colobopsis* section of *The Ants of North America* (4). Since I could see no possibility of validating Wheeler's treatment of the Vera Cruz majors, *cerberulus* was omitted from the key. I commented on certain geographical discrepancies, which made Wheeler's association seem unlikely, but pointed out that there was little hope for bettering the matter until someone secured a nest of this ant in which both major worker and female were present.

It was, therefore, very gratifying to find such a colony in Garden Canyon, Huachuca Mountains, in July 1950. This colony was a fragment of a larger one, to judge from those subsequently taken, for it contained only eight in-

dividuals. One of these was a deälated female, three were major workers and four were minor workers. The nest was found in a dead limb of *Quercus emoryi*. As soon as possible I took this nest to Harvard for comparison with material identified as *cerberulus* in the Wheeler Collection. This was put at my disposal through the courtesy of Dr. Joseph Bequaert whom I wish to thank for this kindness. The material labelled as *cerberulus* in the Wheeler Collection consisted of Skwarra's specimens from Vera Cruz and a series of females from Texas Pass in the Dragoon Mountains. To save possible confusion in the future it seems well to note that on the locality labels of these specimens the name is mispelled as the "Dragon Mountains". Texas Pass is a low pass at the western end of the Dragoon Mountains, through which the highway between Willcox and Benson now runs. The specimens from Sabino Basin and Black Dike Prospect, which Wheeler mentioned in 1934 could not be found. It is probable that these specimens are now in the collection of the American Museum of Natural History.

As I had expected, the female from Garden Canyon proved to be identical with those from Texas Pass. But the Garden Canyon majors were not the same as those from Vera Cruz. I have presented the differences in detail on a subsequent page. They need not be discussed here other than to state that, in my opinion, these differences clearly show that the two insects belong to separate species.

While the above comparison does not cover the second part of Wheeler's double association, it has given results significant to it. The head of the major of *Colobopsis*, like that of most species of ants in which this caste is present, differs more or less from that of its accompanying female. But there is no rule which governs the degree of difference. The amount of differentiation varies with the species and this circumstance defeats any attempt at anticipating the finer structure of one caste from that of the other. Since this is the case it should be obvious that nothing can be done with *cerberulus* until the unique female type can be proven identical with a female whose major worker is known. That this could be done by using Emery's

description appears to the writer to be utterly impossible. Nor do I believe that a comparison of Emery's type with material now present in American collections would necessarily be conclusive. Since the Vera Cruz specimens are specifically different from those which occur in southern Arizona, there is good reason to suppose that the Michoacan type is also different. In all likelihood, therefore, a comparison of Emery's type with females taken in southern Arizona would merely substitute a new problem for an old one. For, unless the two proved identical, we would still have no idea as to the characteristics of the major of *cerberulus*. In all probability the nature of Emery's *cerberulus* will remain enigmatical until extensive collections of arboreal ants can be made in Vera Cruz and Michoacan. When complete colonies of *Colobopsis* can be taken in these states and compared with Emery's type the primary difficulty in the *cerberulus* problem may be overcome.

But we cannot wait until this is done to deal with a secondary difficulty which has resulted from Wheeler's unfortunate association. Since the Vera Cruz majors are specifically different from specimens coming from southern Arizona, the least that can be done is to provide a new name for one or the other of these insects, in order that the two species can be handled without violating nomenclatorial rules. I am convinced that it is best to treat the Arizona material as a new species for the following reasons:

(1). If only one new name is proposed the remaining species will have to be considered as *cerberulus* until this can be definitely authenticated or certainly disproved.

(2). From the standpoint of proximity it is much more likely that the Vera Cruz majors should be the same as the type of *cerberulus*. Southern Arizona lies seven hundred miles to the north of Vera Cruz and Michoacan. But the two states themselves are separated by less than two hundred miles and they lie in approximately the same latitudes.

(3). Any additional description in the case of the *cerberulus* complex should deal with adequate material about which there must be no occasion for speculative association. The Arizona material fully meets this condition. The Vera Cruz majors obviously do not. In connection

with this last point it seems worth noting that in the ten colonies on which this study was based there were 23 females, 2 males, 104 major workers and 194 minor workers. These totals do not include 20 additional females taken at light.

There follows the description of the above material:

**Camponotus (Colobopsis) papago** sp. nov.

Major worker: head 1.06 mm., thorax and petiole 1.5 mm., overall length 4.5 mm. (Plate 13, figure 3)

Truncated portion of the head distinctly concave, with a low, serrate flange bordering either cheek but not continued across the top of the clypeus. The entire clypeus raised slightly above the level of the adjacent portions of the cheeks, which slope downward to the clypeus from the bordering flange. Sculpture of the truncated portion of the head consisting of coarse, irregular ridges which form reticulations. These reticulations and the areas which they surround, are covered with numerous, very fine, crater-like punctures. These punctures do not dull the shining surface. Sculpture on the mandibles rough but not distinctly reticulate. Seen from above the frontal lobes are covered with even reticulations which surround circular or nearly circular depressions. This reticulate sculpture extends almost to the level of the single median ocellus, with the depressions becoming shallower and more widely spaced towards the rear. The rear third of the head is finely shagreened and notably more shining, particularly at the occipital corners, than is the heavily sculptured front of the head. The reticulation on that part of the clypeus which lies behind the truncation is much less even than that on the frontal lobes. Reticulation on the cheeks less even and somewhat coarser than that on the frontal lobes. The entire anterior half of the head with the same fine, crater-like punctures which occur on the truncated portion. A very feeble frontal furrow is visible in certain lights. Antennal scapes rather strongly shining with small, white, appressed hairs. Hairs on the truncated portion of the clypeus and on the front face of the mandibles very strongly clubbed and shaped like tear drops. Hairs along the outer border of the mandibles, on the

frontal lobes and on the sides of the head behind the truncation long, curved, blunt and often clavate but rarely as strongly clubbed as those of the clypeus.

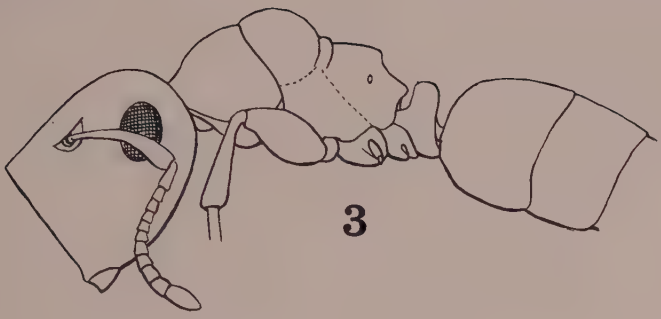
Thorax, petiole and gaster more finely shagreened than the head with the surface strongly shining. In addition to the shagreening there are very small scattered punctures present, from which arise short, delicate, fully appressed hairs. No erect hairs present on the thorax, those on the crest of the petiole very short and fine. Erect hairs rather sparse on the gaster, mainly confined to the row at the posterior edge of each segment. Legs finely shagreened and strongly shining with delicate, appressed hairs like those of the thorax. Fore femora expanded dorso-ventrally and strongly compressed laterally. The tarsal joints and the funiculi covered with abundant, short, yellowish, semi-erect hairs. Color deep blackish brown, the anterior third of the head clear yellowish brown. Tarsi, funiculi, base of the petiole and the sutures of the thorax light brown.

Worker minor: head 0.9 mm., thorax and petiole 1.25 mm., overall length 3.25 mm. (Plate 13, figure 2)

Head, seen from the front, with the eyes notably more convex than those of the major, the sides in front of the eyes narrowing to the insertion of the mandibles. Mandibles with four well-developed teeth. Clypeus moderately convex from side to side, somewhat more strongly convex from front to rear, ecarinate or with a very blunt and indistinct carina. Frontal lobes together forming a trapezoidal area which is a little wider behind than in front. Frontal groove absent. Occiput evenly convex, the lateral portions meeting the posterior border of the eyes without any distinct posterior angles. The antennal scape, when extended straight to the rear, surpasses the occipital border by an amount slightly less than its greatest thickness. Head, thorax and abdomen moderately shining with a rather strong, reticulate shagreening. Appressed hairs as in the major and female. Erect hairs long, tapered and with sharp tips. They are rather numerous on the man-

EXPLANATION OF PLATE 13

*Camponotus* (*Colobopsis*) *papago*. Fig. 1. Female. Fig. 2. Minor worker. Fig. 3. Major worker. (All figures drawn to same scale.)



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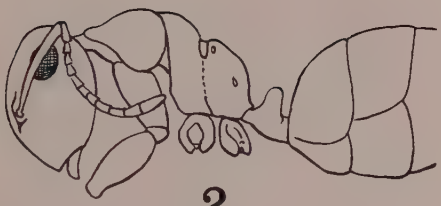

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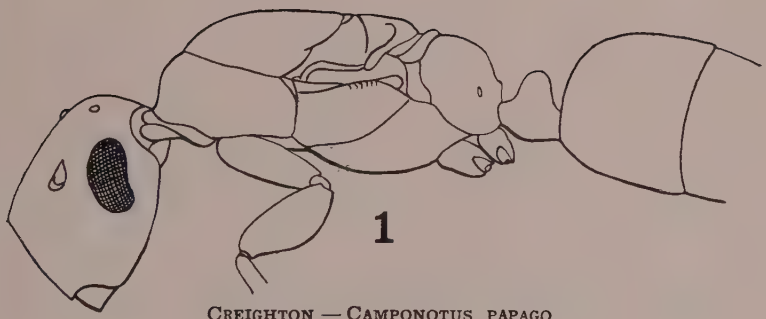

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CREIGHTON — CAMPONOTUS PAPAGO

dibles and clypeus, sparser on the front and represented on the occiput by a single pair. Thorax without erect hairs. Crest of the petiole with several very short, delicate erect hairs. Erect hairs on the gaster widely and rather evenly spaced over the dorsum except at the base of the first segment, which is hairless. Fore femora laterally compressed as in the major. Color: blackish brown, the mandibles and tarsal joints light brown.

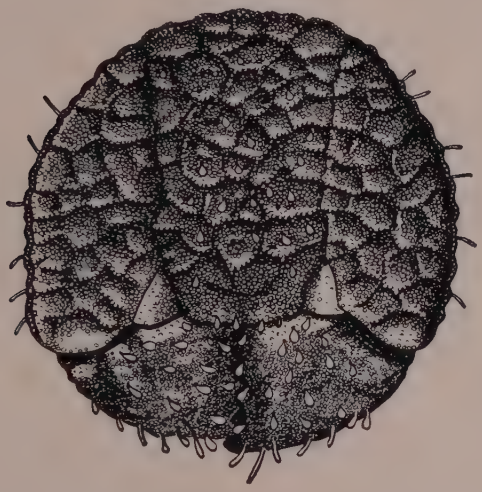
Female: head 1.25 mm., thorax and petiole 2.3 mm., overall length 6.0 mm. (Plate 13, figure 1)

Head similar to that of the major but with all three ocelli large and prominent. Sculpture on the truncated

Text-figure 1. Upper surface of the head of the major worker of *Camponotus* (*Colobopsis*) *papago* sp. nov.

portion of the head identical with that of the major. Reticulate sculpture on the frontal lobes smaller and shallower than that of the major and not extending as far back on the head. Eyes distinctly larger and more convex than those of the major. Hairs on the mandibles and the truncated portion of the clypeus longer and less clubbed than those of the major.

Thorax feebly shagreened and rather strongly shining, with small, scattered, appressed hairs as in the major. Erect hairs absent on the thorax except for a pair of long, yellowish hairs which arise from the scutellum. Gaster more feebly shagreened and more strongly shining than the thorax but with similar appressed hairs. Erect hairs on the gaster only moderately abundant, mostly confined to a row at the rear of each segment. Erect hairs on the terminal gastric segment distinctly longer than those elsewhere. Fore femora laterally compressed as in the major. Color blackish brown, the anterior quarter of the head, much of the scutum and the middle and hind tarsi yellow-



Text-figure 2. Truncated surface of head of major worker of *Camponotus* (*Colobopsis*) *papago* sp. nov.

ish brown. Wings hyaline, iridescent and with pale yellowish veins.

Male: Head 0.7 mm., thorax 1.5 mm., overall length 3.5 mm.

The sides of the head in front of the eyes taper slightly from the anterior edge of the eye to the insertion of the mandible. Behind the eyes the sides of the head are evenly

convex from the rear edge of the eye to the lateral ocellus. The occipital border is slightly concave between the lateral ocelli. Anterior border of the clypeus feebly sinuate. Mandibles small, somewhat spatulate and with the teeth represented only by a V-shaped notch on the masticatory margin. Antennal scapes long, surpassing the occipital margin by a little more than one-third their length.

The greatest width of the thorax, when seen from above is approximately equal to that of the head. In profile the neck of the pronotum is short, the anterior face of the scutum is evenly rounded and its dorsal face is flat and on the same level as the anterior edge of the scutellum. The latter is convex in profile and descends sharply in the rear. In profile the epinotum is depressed well below the level of the scutellum, rounded and without a good separation between the basal and declivious faces. Petiole with a short but distinct anterior peduncle, the node low in profile, tapering slightly from base to crest with the latter evenly rounded. Seen from above the node of the petiole is transversely oval, with the width about twice the thickness from front to back. Gaster approximately as long as the thorax. Genitalia small and obscure.

The surface is moderately to strongly shining. Front and genae strongly shining with scattered punctures. Occiput and scutum less shining with a delicate reticulate sculpture. Scutellum very shining with scarcely any sculpture. The remainder of the thorax and the node of the petiole with a reticulate sculpture which is less pronounced than that of the scutum. Gastric sculpture very feeble, shagreened but scarcely reticulate, the surface more shining than that of most of the thorax. Sparse erect hairs are present on the head, the coxae and the gaster. Thorax without erect hairs. Antennal scapes, the femora and the tibiae with very delicate, short, sparse hairs which are fully appressed. Pubescence on the antennal funiculi and the tarsal joints suberect and not particularly prominent. Thorax and gaster dirty, yellowish brown, the head distinctly darker. Wings hyaline and iridescent with the veins very pale.

Types of female, male, major and minor worker deposited

in the Museum of Comparative Zoology, Cambridge, Mass. The type locality is Forestry Cabin (Baboquivari Canyon), Baboquivari Mts. (3500′), Arizona. The type nest was taken on July 24, 1951 in *Quercus emoryi*. Four other colonies were taken in this same station. In addition four more colonies were secured near Perkins Ranch in Brown Canyon on the eastern slope of the Baboquivari Mountains. These last colonies were situated at elevations between 4100 and 4600 feet. Mention has already been made of the single colony taken in Garden Canyon in the Huachuca Mountains. The elevation of the station from which this colony came was 5800 feet.[1]

In the following paragraphs are given the results of the comparison between the major workers of *papago* and the three major workers from Vera Cruz which may be *cerberulus*:

1. In *papago* the length of the head is shorter in proportion to its width and the sides of the head in front of the eyes are slightly convex when the head is viewed from above. In the Vera Cruz majors the sides of the head in front of the eyes are straight or nearly so when the head is viewed from above.

2. In *papago* the scape only slightly surpasses the occipital margin. The amount of the scape which projects beyond the margin is notably less than the greatest diameter of the scape. In the Vera Cruz majors the scape surpasses the occipital margin by an amount equal to the greatest diameter of the scape.

3. In *papago* the triangular lateral portion of the mandible is feebly and irregularly concave on its anterior face. In the Vera Cruz majors the triangular, lateral portion of the mandible is so strongly concave on its anterior face that the tip of the triangle appears to point forward.

4. In *papago* the truncated portion of the clypeus is uniformly covered with coarse, reticulate ridges. In the Vera Cruz majors this portion of the clypeus is also reticu-

[1] Since the above was written nests of *C. papago* have been taken by the writer in Cottonwood Canyon, Peloncillo Mts. (4800′), Arizona and fourteen miles north of Imuris, Sonora (3200′), Mexico. In both cases the ants were nesting in *Q. emoryi*.

late but at the middle of the clypeus there is a heavy, median ridge which runs from front to back. This ridge is wavy but it is not reticulate.

5. In *papago* the portion of the clypeus behind the truncation is not clearly set off from the frontal lobes and the frontal area is indistinct. In the Vera Cruz majors the portion of the clypeus behind the truncation is clearly separated from the frontal lobes and the frontal area, although small, is very distinct.

6. In *papago* the serrate flange at the edge of the truncated portion of the head is lower and less prominent than that of the Vera Cruz majors.

7. In *papago* the erect hairs on the sides of the head are longer, more numerous and less clavate than those of the Vera Cruz majors. In both species most of the hairs on the mandibles and the truncated portion of the clypeus are so strongly clubbed that they are shaped like tear drops. It is strange that Wheeler made no mention of these conspicuous and characteristic hairs. From a practical point of view they furnish the easiest means for distinguishing *papago* from any other species which occurs in the United States. None of our other species have such hairs, hence there is no possibility of confusing *papago* with any other species if these hairs are made the basis for its recognition.

Before concluding this paper I wish to present an account of the habits of *C. papago*. The ten colonies taken to date have all come from evergreen oaks or mesquite trees. The two oaks involved are *Quercus emoryi* and *Q. oblongifolia*. Most nests are constructed in the stubs of broken-off branches which have a diameter of an inch and a half or more. The thickness of the stub seems to be more important than its length. I have taken colonies from stubs less than six inches long but I have yet to see one in a branch that was small enough to be considered a twig. Inside the stub are numerous, narrow passages which roughly parallel the grain of the wood. Several openings lead from these to the outside. It is evident that in a fully developed nest of *papago* there must be several "janitors" on duty at the same time. As mentioned above, this ant does not ordinarily nest in twigs. At first I supposed that

this reaction might be due to a scarcity of trees which have twigs with a suitable central pith cavity and this may be a part of the explanation. But it now seems certain that moisture plays a large part in the choice of nest site. I had realized that *papago* usually nests in limb stubs which point upward long before I saw any significance in this response. But on one occasion I was examining limb stubs immediately after a heavy and prolonged rain storm. I found that the stubs which pointed upward caught and held the rain water much as a cistern would. Rain soaked into the fractured upper end of the stub and accumulated at its lower end. The lower end was often so wet that water would drip out of it after the stub was knocked loose from the tree. In contrast, the horizontal stubs and those which pointed downward caught far less rain. The latter were often quite dry inside, despite the fact that they had been drenched with rain for several hours previously. It thus appears that the female of *papago*, in choosing a nest site in limb stubs which point upward, takes advantage of a natural system of water conservation. This could certainly be one reason why the nesting habits of *papago* differ from those of the eastern twig-dwelling species. It may be added that the preference of this ant for nesting in the stubs of broken-off limbs seems to be one factor which has kept it out of the hands of collectors. It was some time before I realized that the most important piece of equipment needed to collect *C. papago* is a heavy axe. The nests are almost always built in sound, hard wood and it is not easy to get the insects out, even after the stub has been knocked loose. The ants which are in the lower passages can often be jarred out by whacking the stub with the back of the axe. But to get all of them the stub must be split into pencil-sized pieces. Anyone who makes a practice of collecting *papago* will never lack for exercise.

The majors of *C. papago*, when disturbed, have a curious habit of exuding from the mouth a sticky, greyish fluid. This often spreads backward over the truncated portion of the head. If it is allowed to dry there it forms a crust that is almost impossible to remove. As to what the use of this fluid may be is hard to say. It may have repellant

characteristics for other ants and thus serve as a defensive mechanism which the major employs when acting as a janitor at the nest entrance.

It is safe to infer that *C. papago* forages at night. Although I have examined hundreds of oak and mesquite limbs, some of which later proved to contain flourishing colonies of *papago*, I have never seen a worker outside the nest. This foraging must be a slow business, for *papago* is a rather sluggish ant. The minor workers can move with fair speed but the majors are so slow that it is easy to pick them up. Finally, the marriage flight of *papago* occurs throughout the month of July. In an ordinary year it would thus take place during the first half of the summer rainy season.

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